ADVANCED REACTOR, FUEL CYCLE, AND ENERGY PRODUCTS WORKSHOP FOR UNIVERSITIES

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Advanced Fuel Cycle R&D

Separations and Waste Forms

ANL, INL, LANL,ORNL, SRNL, PNNL

Workshop for Universities
Hilton Hotel, Gaithersburg, MD
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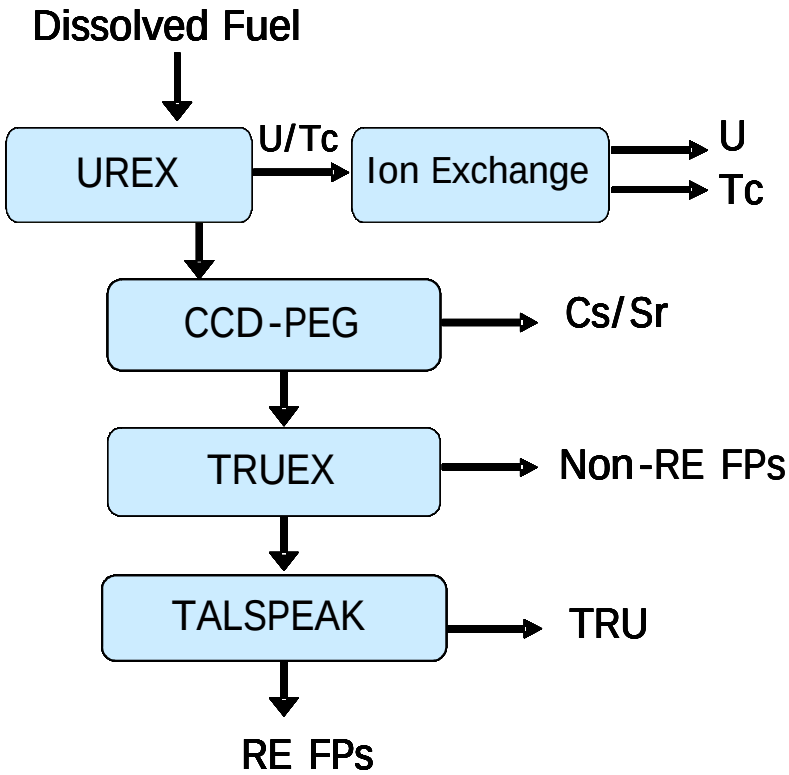
Area Overall Work Scope

- *Develop, demonstrate and deploy advanced technologies for recycling spent nuclear fuel that do not separate pure plutonium*
  - *Substantially reduce nuclear waste*
  - *Simplify its disposition*
  - *Ensure the need for only one geological repository in the United States through the end of this century*

FY06 ACCOMPLISHMENTS

- UREX+1a Integrated Process Laboratory-Scale Demonstration with LWR Spent Fuel
  - Successful TALSPEAK Process Development
- Engineering-scale recycle demonstration facility
  - Develop design concept and cost estimate
- Scaling of the Waste Form Production and Qualification

UREX+1a Integrated Process Laboratory-Scale Demonstration with LWR Spent Fuel



- **What was demonstrated ?**
  - Process run with actual spent fuel dissolved in HNO_3
  - Recovery of U, Tc, Cs/Sr, TRUs, RE, and non-RE FP
- **Results**
  - Excellent hydraulic performance
  - Surpassed ALL process goals
  - TALSPEAK process far exceeded decontamination requirements
    - Fuel requirements (lanthanide DF > 2,000)
    - Repository requirements (> 99.99% TRU recovery)

TALSPEAK – Where we are today

- Clear understanding of pH effects on distribution of Lanthanides
- Near-equilibrium distribution of lanthanides and actinides requires:
  - Enough contact time to allow for mass transfer
  - Mixing intensity that provides interface surface area

	2005 results		***2006 results***	
Component	**RAFFINATE (TRU Product)**	**PRODUCT (Ln)**	**RAFFINATE (TRU Product)**	**PRODUCT (Ln)**
Pu	**99.999**	**0.001**	**>99.99**	**<0.01**
Np	**99.999**	**0.001**	**>99.99**	**<0.01**
Am	**99.999**	**0.001**	**>99.99**	**<0.01**
Cm	**-**	**-**	**>99.999**	**<0.001**
Nd	**22**	**78**	**<0.02**	**>99.98**
Eu	**16**	**84**	**<0.05**	**>99.95**
∑ Ln	**12**	**88**	**<0.05**	**>99.95**

WORK IN PROGRESS FOR FY07

- ***Separations***
  - *Completed 3 TALSPEAK demonstrations to determine process operating envelop*
  - *Completed FPEX flowsheet design to replace CCD-PEG process*
  - *Perform UREX+3 COEX or UREX+1a flowsheet demonstration*
    - *Using LWR spent fuel*
    - *Replace CCD-PEG with FPEX process*
  - *Demonstrate Voloxidation process at low temperature for tritium recovery*
  - *Develop automated product removal system for the planar electrorefiner (PEER)*
  - *Develop and demonstrate performance of electrolysis cell for group actinide recovery*
  - *Develop oxide reduction process for UREX+ product conversion*
- ***Waste/Product Forms***
  - *Develop test plan to optimize and scale up Tc waste form process*
  - *Evaluate alternatives for Cs/Sr waste form*
  - *Evaluate alternatives for Iodine capture*

PLANS FOR FY08-09

- ***Separations***
  - *Continue development of UREX+ processes for treatment of LWR spent fuel*
  - *Continue simulation efforts to support process design, safeguards and accountability of recycling facilities*
  - *Initiate development of aqueous and electrochemical based processes for the treatment of advanced recycle fuels*
  - *Optimize recycling facilities such that they are easier to safeguard and allow improved material accountability*

- ***Waste/Product Forms***
  - *Evaluate economic feasibility of hulls decontamination for LLW disposal*
  - *Select base line for all waste and product forms for the recycling of LWR spent fuel*
  - *Initiate R&D supporting certification of waste and product forms*
  - *Continue simulation efforts to support license applications for both product and waste forms*